

Interactive comment on “New particle formation events measured on board the ATR-42 aircraft during the EUCAARI campaign” by S. Crumeyrolle et al.

S. Crumeyrolle et al.

s.crumeyrolle@opgc.univ-bpclermont.fr

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We thank referee #2 for his constructive comments on our manuscript. We have revised the manuscript attempting to take into account all the comments raised.

Referee 2. .R2.1 Specify the method of new particle classification by Dal Maso. The method of new particle classification by Dal Maso can be summarized as follows: The time series of the particle size distributions have been studied visually, and the subsequent “event” or “non-event” classification is based on this analysis. Days were classified either as event days, showing a clear new particle formation burst in the data or as non-events days with no sign of new ultrafine particle appearance, or finally unde-

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finer days, where some ultrafine particles were present but it was not evident that new particle formation was taking place. To qualify a day as an event day, a new particles mode had to appear in the size distribution in the nucleation mode (<25 nm diameter) and prevail continuously for more than one hour. Furthermore, the size of the new particles needs to increase with time; the latter requirement was accounted for by particle formation occurring over a large region, and thus producing a significant amount of potentially growing nucleation mode aerosol particles. The above discussion has been added in subsection 3.1 “Observation of atmospheric nucleation”

Referee 2. R2.2 It would be good to get some classification of nucleation events in terms of the degree of pollution of the air - for example, classification by black carbon levels and by accumulation mode concentration would be useful.

We agree with the reviewer that classification of the nucleation events as a function of the degree of pollution is useful. Since the BC concentration cannot be retrieved via PSAP measurements due to technical problems during the first half of the flight missions, we use the accumulation mode concentration from the SMPS measurements as a proxy. The total concentration of particles with diameters larger than 100 nm is considered as accumulation mode particles.

The upper and lower limits of the accumulation mode concentration are given in the table1 (given in the supplement) for the horizontal legs of all nucleation events observed during the EUCAARI campaign. We can distinguish three levels of air pollution: low (RF53/RF54), moderate (RF43/RF45/RF48 (fig4b) /RF61) and high (RF48). Both events of the low level pollution group are similar in terms of homogeneity and concentration. Only one event has been observed under highly polluted air conditions, thus no comparison could be performed. During moderate pollution levels, two nucleation types appear: the first one is homogeneous over the entire flight leg and is characterized with high contents of nucleated ultra-fine particles (RF43/RF48), while the others are inhomogeneous over the flight leg and yielded lower contents of ultra-fine particles (RF61/RF45). The concentration of ultra-fine particles and the homogene-

ity/inhomogeneity character show no tendencies as a function of accumulation mode particle concentration.

Air masses of different origins are associated to different meteorological regimes and chemical characteristics, and therefore, from the Eulerian viewpoint, the probability of occurrence of new particle formation events at a given location and time does not only depend on local emissions, but rather on long range transport (Sogacheva et al., 2005a). In our study, the chemical composition of accumulation mode particles, measured with the AMS, is totally different as a function of air mass origins. Thus, we assume that precursor gases are also depending on air mass origins and trajectories. As no measurements of precursors have been performed on board the ATR-42, this assumption cannot be proved.

Thus, we added a few lines to discuss the classification as a function of the degree of pollution, according to the referee's suggestion. Anyway, the value of that kind of correlation is limited due to lack of statistics.

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Table 1:

Figures	Flight	Altitude (m)	N_{100} (cm^{-3})	Pollution levels	N_{3-10} (cm^{-3})
3a	RF43	300	3000-4500	Moderate*	100000
3b	RF45	300	3000-4500	Moderate+	2000-17000
3c	RF48	600	4000-8000	High*	18000-100000
4a	RF43	600	3000	Moderate*	50000-100000
4b	RF48	600	2000-4500	Moderate*	17000-60000
5a	RF53	600	500-800	Low*	20000-70000
5b	RF54	850	500-950	Low*	20000-70000
6	RF61	600	500-2500	Moderate+	10000-40000

* homogeneous NPF events
+ inhomogeneous NPF events

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Fig. 1.